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Research Article

Digital Teaching Management System Based on Deep Learning of Internet of Things

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In order to solve a series of problems similar to the repetitive construction of resources and low degree of resource sharing in cruciform teaching, this paper studies the digital disarming management. Based on the in-depth analysis of the actual needs of the digital teaching resource service system and the key problems in the system, taking the resources and business process as the starting point, based on Java Web related technology, combined with the related processes of resources and business processing, this paper designs the digital teaching resource system of colleges and universities. The system has the functions of resource digitization, process management, and interaction with other platforms. The system database platform and operation platform are built; the development environment is configured; and the user login service function, data conversion service function, process management service function, and system management service function are completed. The function is tested by unit test, and the performance is tested and analyzed according to user requirements and design objectives. The system adopts Java web development technology, uses S2SH framework as the development basis, and takes Oracle database as the data storage platform through Tomcat6.0 web server for program publishing. Through system testing and analysis, the software can operate normally and achieve the expected functions and can be put into use.

1. Introduction

Deep learning is machine learning. Recently, recognition and other applications have made breakthrough progress. Edge and initial shape are detected in primate visual system, and then signal processing is carried out to visual shape. lower-level features to display features and features of more abstract top-level representations, attribute categories, or hierarchical data. Deep learning compared with "surface support vector machine (SVM) and other "learning" methods has more layers of fear operation. [1]. Shallow learning is to extract sample features through artificial experience and to obtain a single feature without hierarchy through. It provides more extensive expansion and development for traditional education in space and by transforming the original signal features step by step and automatically learns hierarchical feature representation. Another theoretical motivation of deep learning theory is that if a function can be expressed in a concise form K-layer structure, which can resurrect exponential digital band officials (relative to input signals), this information digital technology has been widely used. Digital education is an important application of digital technology in the field of education. Digital education refers to the introduction of computer technology, electronic technology, communication technology, and other modern information technology means in education to effectively provide solid support and high-quality services for education and teaching [2]. It provides more extensive expansion and development for traditional education in space and time and provides educators and educatees with a digital education environment beyond the limitations of distance and time. This education method is imperceptibly changing the educational concept and means, as shown in Figure 1. Digital education includes digital resources, digital teaching equipment, digital teaching process, and many other aspects.

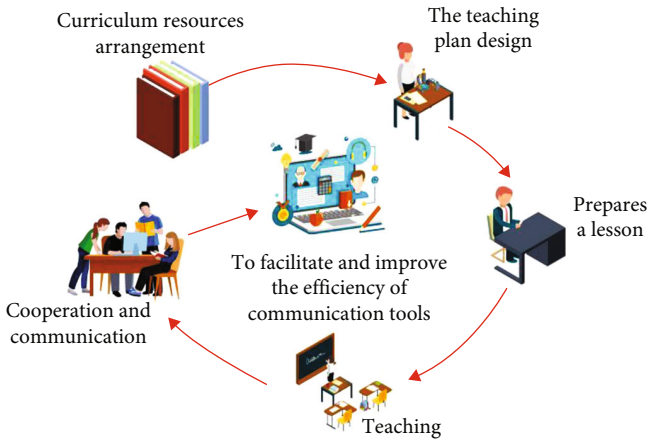

Figure 1: Digital teaching flow chart.

Digital resources are the basis of other aspects. It will provide resources and data services for digital education software and teaching system, and it is also the basis of all data processing. The main forms of digital education include digital teaching environment, digital teaching software, online teaching system, testing system, and evaluation system. Digital teaching resources can provide resources and data services for the above forms of expression. At the same time, digital teaching resources can also build and improve data through a variety of teaching forms and finally achieve the purpose of better serving education and teaching [3].

2. Literature Review

Noreen and others said that in the industry, information digital technology has been widely used. Digital education is an important education. Digital education refers to the introduction of computer technology, electronic technology, communication technology, and other modern information technology means in education to effectively provide solid support and high-quality services for education and teaching [4]. Al and others said that they have provided more extensive expansion and development for traditional education in space and time and provided educators and educatees with a digital education environment beyond the limitations of distance and time. This education method is imperceptibly changing the educational concept and means [5]. At present, the relevant hardware and equipment can meet the requirements, but the software is developed based on the requirements. In order to embody the vitality of online education resources, corresponding software support is required [6]. The construction of network teaching resource management information system in colleges and universities aims to solve the management of important teaching resources and realize the sharing of teaching resources. Others believe that the network teaching resource management information system in colleges and universities has improved the utilization rate of resources and promoted the teaching management under the new situation [7]. Maseer and others said that higher education has the educational and teaching characteristics of letting a hundred flowers bloom. Colleges and universities are the synthesis of various educational ideas and methods. Digital education provides the driving force for the rapid development and growth of this large educational environment, and the digital teaching resource system of colleges and universities has become the basis construction of digital education in colleges and universities [8]. For Zhang, various query functions provided by the query module can facilitate users to quickly locate resources. Users can define personalized queries and store them for later use. The log management module records each user's operation on the system. In case of malicious use [9], Wang and others believe that the network is formed by convoluting a single layer to a large number of times of the large layer. The connection between each two nodes represents that the input node becomes an output node but the software is built according to the needs. Therefore, the construction of online education resource management information system in colleges and universities has become the focus of research, which aims to solve the construction of an all-round teaching resource management information system and realize the sharing of teaching resources, so as to change teaching methods, improve teaching level, and improve the utilization rate of educational resources, which can promote teaching management under the new situation [10]. Idrissi and others believe that usually, system testing is unit testing, that is, module testing. For unit testing, this paper uses the methods of black and white box testing to test the system. The testing methods of software system are various, but testing does not mean that all possible tests are carried out with a large amount of data [11]. Govindaraj, D.R. and others also have some opinions on the teaching resource management information system. Due to the lack of corresponding technical specifications and standards, there are many problems in the actual use of teaching resource management system. For example, due to the insufficient planning of resource database construction, the connection between resource construction and teaching activities is not close, and the existing public resources cannot be fully utilized. In addition, the awareness of information service cannot keep up, resulting in the repeated construction of the resource library or the insufficient number of effective resources of the resource library [12]. Mao and others believe that colleges and universities have a history of more than ten or even hundreds of years and have accumulated rich teaching resources and there are many kinds of teaching resources, such as video, voice, and teaching courseware. Only by building a scientific and reasonable teaching resource management system can these valuable resources reflect their value [13].

3. Method

3.1. Deep Learning. The resource management system in schools has achieved the purposes of convenient maintenance, convenient data statistics, easy maintenance, simple and beautiful interface, efficient query and retrieval function,

and so on. The development of college teaching resource is a systematic project, which integrates college teaching to the extent and realizes the sharing of teaching resource information, so deep network is a deep neural network, namely, deep neural networks (DNN). The encoder provides a bottom-up mapping from the input to the implicit feature space, and the decoder maps the implicit feature input feature space. The goal is to use the result for input as much as possible [14]. Deep neural networks are divided into the following three categories (as shown in Figure 2):

(1) Feed forward deep networks (FFDN) is composed of multiple encoder layers, such as multilayer perceptrons (MLP) and convolutional neural networks (CNN)

(2) Feedback deep networks (FBDN) is composed of multiple decoder layers, such as deconvolution networks (DN) and hierarchical sparse coding (HSC)

(3) Bidirectional deep networks (BDDN) is composed of superimposing (process or decoding process or both encoding process and decoding process), such as deep Boltzmann machines (DBM), deep belief networks (DBN), and stacked auto encoders (SAE) [15]

3.1.1. Feed Forward Depth Network. Feed forward neural network is one of the most primitive models in artificial neural network. In this network, information flows in the network. Typical feed forward neural networks include multilayer listeners and convolution neural networks neural network [16].

(1) Single Layer Convolutional Neural Network. In the convolution stage, its observation mode is also called convolution kernel. In order to extract different features on the input feature map, different convolution kernels are used for convolution operation. The input of convolution stage is a three array composed of n_1 two fear maps of $n_2 \times n_3$ size. Each feature map is marked as x_i, and the output y of this stage is also a three-dimensional array composed of m_1 feature maps of $m_2 \times m_3$ size. In the convolution stage, the weight connecting the input characteristic graph x_i and the output characteristic graph y_i is recorded as w_{ij}, that is, the size of the convolution kernel (local receptive field) of the trained convolution kernel is $k_2 \times k_3$, and the output characteristic graph is shown in Formula (1):

$$y_i = b_j + \sum_i w_{ij} * x_i, \tag{1}$$

where $*$ is a two-dimensional discrete convolution operator and b_j is a trainable bias parameter.

In the nonlinear stage, by separating representation layers and business logic layers, when the client changes, the logic of the data or application server does not need to be changed, which can greatly improve the adaptability of the system module, and the logic of the data or application server does not need to be changed. They are taken as the

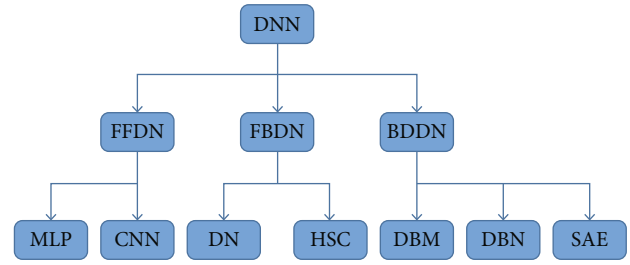

Figure 2: Classification structure of deep neural network.

input for nonlinear mapping $R = h(y)$. In traditional convolutional neural networks, saturation nonlinearity functions such as sigmoid and soft sign are used for nonlinear operation. In recent years, nonsaturation nonlinearity function relu (rectified linear units) is mostly used in convolutional neural networks. When the training gradient decreases, the result has faster convergence speed than the traditional saturation nonlinearity function. Therefore,when training the whole network, the formulas of four functions are shown as follows [17]. The formulas of four functions are shown as follows:

Sigmoid:

$$R = \frac{1}{1 + e^{-y}}. \tag{2}$$

Tanh:

$$R = \frac{e^{y} - e^{-y}}{e^{y} + e^{-y}}. \tag{3}$$

Softsign:

$$R = \frac{y}{1 + |y|}. \tag{4}$$

ReLU:

$$R = \max(0, y). \tag{5}$$

Its function form is shown in Figure 3.

In the down sampling stage, each feature graph is operated independently, usually using the operation of average pooling or maximum pooling. Average pooling calculates the average value of pixels in a specific range according to the defined neighborhood window. P_A is the translation step of neighborhood window which is greater than 1 (less than or equal to the size of pooled window); maximum pooling replaces the mean value P_A with the maximum value P_M and outputs it to the next stage. Some convolutional neural networks have completely removed the lower sampling phase and achieved the goal of lowering the resolution by setting a convolutional nuclear window slip step greater than 1 during the convolution phase [18].

(2) Convolutional Neural Network. A network is formed by stacking a single-layer convolutional for a large of times of

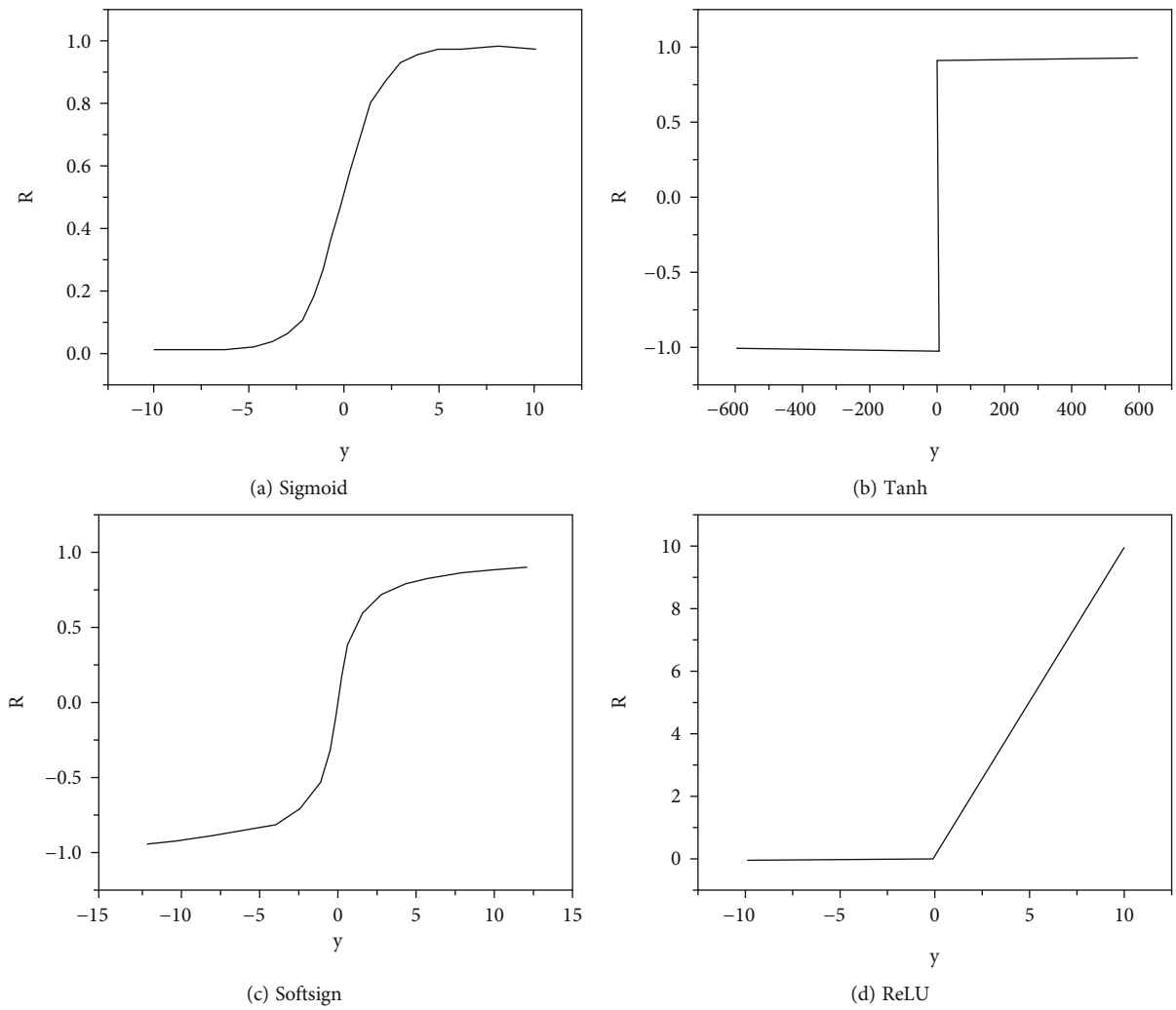

Figure 3: Four nonlinear operation functions.

the great layer. The connection between each two nodes represents that the input node becomes an output node after three stages: convolution, transformation, and sampling. Finally, in order to reduce the over fitting of data, the feature graph will pass through the connection layer and the classifier. Recently, some convolutional neural networks have introduced the method of "dropout 2" or "dropconnect 53" in the full connection layer, that is, in the process of training, with a certain probability P clears the output value of the hidden layer node (which is the input weight for dropconnect) to 0. When updating the weight with the back propagation algorithm, the weight connected to the node will not be updated. But both methods will reduce the training speed. When training convolutional neural network, the most commonly used method is to adopt back propagation law and supervised training method. The algorithm flow is shown in Figure 4. The signal in the network propagates a forward feature to the output feature. The input X of the first layer passes through multiple convolution neural network layers and becomes the characteristic diagram of the output of the last layer 0 [19]. The output characteristic map 0 is compared with the desired label t to generate an error term E. By traversing the reverse path of the network, the error is transferred to each node layer by layer, and the corresponding convolution kernel weight w_{ij} is updated according to the weight update (Formula (6)). During training, the initial values of network weights are usually randomly initialized (or unsupervised training). This process is a map of weights, and the additional forward have a small impact. In the first layer of the convolution network, the weight updating formula between the first input attribute and the first output attribute is shown in Equation (6):

$$\Delta w_{ij} = \alpha \delta_j X_i. \tag{6}$$

When layer L is layer of the convolution network, the expression of δ_j is shown as follows:

$$\delta_j = \left(T_j - Y_j\right) h_L'(X_i), \tag{7}$$

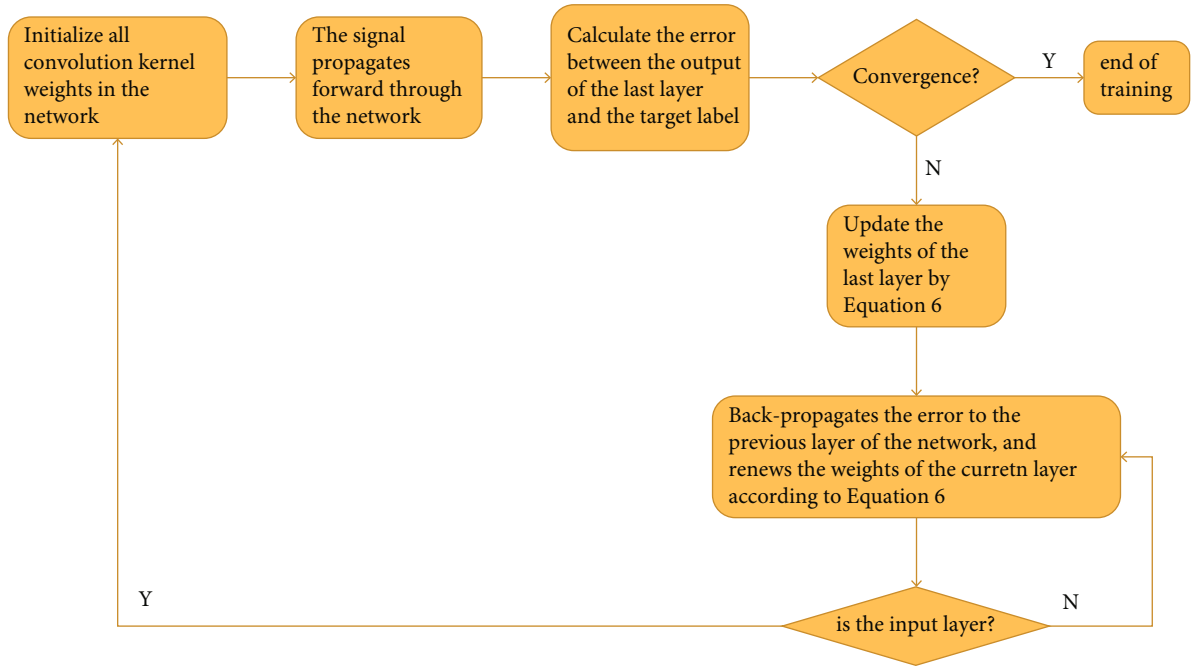

Figure 4: Training process of convolutional neural network.

where T_j is the first label required. In Formula (6), the layer is not the final. $L+1$ is in the following layer; the expression of δ_j is shown as follows:

$$\delta_j = h_L'(X_i) \sum_{m=1}^{N_{L+1}} \delta_m w_{jm}, \tag{8}$$

where N_{L+1} is the number of layer output features, $*$.

3.1.2. Feedback Depth Network. Unlike feed forward networks, feedback networks do not encode the signal. Feed forward network is the process of encoding the input signal, while feedback network is the process of decoding the input signal. Typical feedback depth networks include deconvolution networks and hierarchical sparse coding networks [20].

(1) Single Layer Deconvolution Network. Deconvolution network is a good job method for signal elongation decomposition and reconstruction through prior learning. The great signal is though of fear channels, which can be considered the convolution of the hidden layer and the feature map of the filter bank $f_{k,c}$ (number $K_0 \times K_1$), as shown below:

$$\sum_{k=1}^{k_1} z_k * f_{k,c} = y_c. \tag{9}$$

Since Equation (9) s an inverse Lafite function (most unknowns are more than a large number of equations), in order to obtain its unique solution, it is necessary to introduce a regular term z_k about the characteristic graph, and the cost function is shown in Equation (10):

$$C_1(y) = \frac{\lambda}{2} \sum_{c=1}^{K_2} \left\| \sum_{k=1}^{K_1} z_k * f_{k,c} - y_c \right\|_2^2 + \sum_{k=1}^{K_1} |z_k|^p \tag{10}$$

It is a weighting coefficient that balances rewriting errors and feature mapping.

(2) Deconvolution Network. The deconvolution network can be obtained by a multilayer superposition of network described in the previous section. In the multilayer model, the characteristic map is derived while learning the filter bank. The characteristic map and filter of layer L are obtained by deconvolution calculation and decomposition of the characteristic map of layer L-1. In deconvolution network training, a map of fact signal $y = \{y^1, y^2, \cdots, y^l\}$ is used to solve arg $\min_{f,z} C_l(y)$, and Equation (11) is used to optimize the iterative alternation of f and great graph z. Training starts from the following and uses greedy algorithm to improve by layer. The optimization between layers is independent. Equation (11) shows the objective function T' of a single network in the evolutionary network (objective function of all input signals):

$$C_l(y) = \frac{\lambda}{2}\sum_{i=1}^{l}\sum_{c=1}^{K_{l-1}}\left\|\sum_{k=1}^{K_L} g_{k,c}^{l}\left(z_{k,i}^{i} * f_{k,c}^{l}\right) - z_{c,l-1}^{i}\right\|_2^2 + \sum_{i=1}^{l}\sum_{c=1}^{K_{l-1}}\left|z_{k,i}^{i}\right|^p. \tag{11}$$

The first item in the formula is the error between at the present layer and the right layer, where $z_{k,l}^{i}$ is the characteristic diagram of the current layer; $f_{k,c}^{l}$ is the current layer in the filter library; $z_{c,l-1}^{i}$ is the upper element graph; and $g_{k,c}^{l}$ represents the great graph between the wrong characteristic graph and the output characteristic graph in the same layer, which is a separate representation layer and business logic layers. Generally speaking, the first level is completely connected, and the second level is the variance and weight coefficient of the almost disconnected feature map to compensate the important aim error and dispersion.

3.2. System Design

3.2.1. Overall Structure of the System. The service object of this system is all ordinary users who use campus network. Because there are many levels of users and different levels of computers, the system is required to have the characteristics of simple operation and convenient use. Therefore, establishing a browser based viewing method is an operation method acceptable to most users. The system adopts a three-tier B/S structure. The most important is the first layer, which provides links for users and systems; The second layer is the logic layer, which is used to implement business logic. The third layer is the final layer, which is responsible for the storage, access, and optimization of data information. [21]. By separating representation layers and business logic layers, when the client changes, the logic of the data or application server does not need to be changed, which can greatly improve the adaptability of the system module, and the logic of the data or application server does not need to be changed, which can improve the flexibility module and make the development very social. The structure of the system is in Figure 5. Users can access the system through the browser. The system judges the effectiveness of users on the server side. If users comply with the law, they can obtain corresponding data from the database server and resource server. In the dotted box are the resource server and database server. These two servers can be placed on one machine, and the server can be placed on one machine separately. In this way, the client browser only deals with the server, which can ensure the social of the important server and database server. If attacked, the server will be paralyzed at most, which will not affect data and resources. Especially if the service is open to the Internet, it only needs to assign an actual address to the server, while the resource server and database server adopt virtual local area, which can ensure the security of data to a certain extent [22].

3.2.2. System Function and Composition. The purpose of digital teaching resource management system is to manage digital teaching resources conveniently and provide these

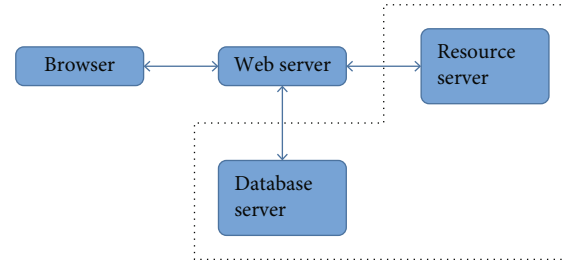

Figure 5: System structure.

resources to users through the network so that users can make efficient use of these resources for network teaching and learning. As shown in Figure 6, the system mainly includes resource management module, video on demand module, user management module, query module, and log module.

The function of module is to comprehensively manage various digital teaching resources, including the establishment of resource database and the setting of resource access control authority. The specific content of resources is stored on the resource server, while the storage location, structure information, and other basic of resources are stored. The resource list information seen by users is obtained from the database, and the specific resource content is placed on the resource server. The VOD module provides users with online VOD function and can provide resource download function according to settings. The module also provides on-demand leaderboard page. The user management module provides user registration, user grouping, user information modification, and other functions [23]. The query module provides various query functions to facilitate users to quickly locate resources. Users can define personalized queries and store them for later use. The log management module records each user's operation on the system. In case of malicious use, the administrator can record the actual data and provide it to the administrator.

3.2.3. System Development Environment. There are two popular choices for system development environment:

(1) Develop with asp net and Microsoft's net framework. The operating system is Windows 2000 or 2003 server. Using net development app, the development cycle is short and easy to maintain

(2) JSP technology is adopted for development, and eclipse integrated development environment is adopted. The middleware uses JDBC and Jakarta Struts as a part of the Java platform, JSP has the characteristics of "write once, run everywhere" of Java language. It can run on more than 85% of servers and is easy to migrate the platform. JDBC is a java database connection middleware, which can provide seamless connection for various common databases. Jakarta Struts is an excellent MVC framework, which can greatly improve the development efficiency of programmers. RedHat Linux 9 can be

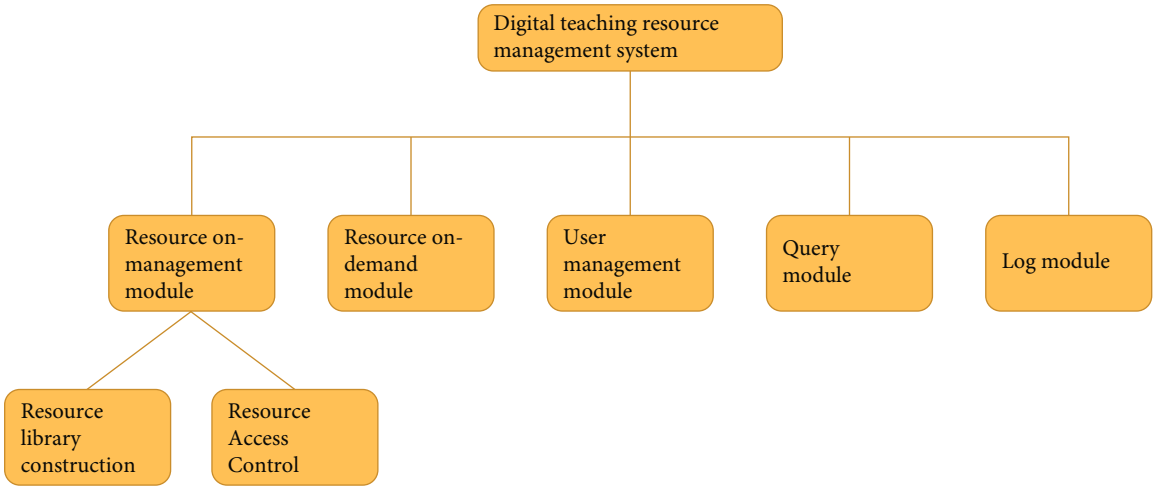

Figure 6: System module diagram.

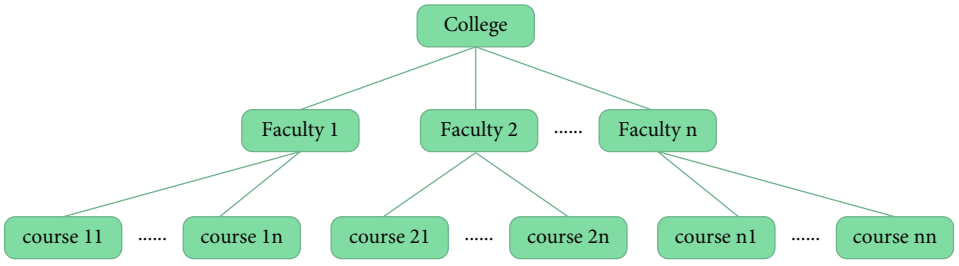

Figure 7: Hierarchy of resources.

used as the operating platform of the database server and Oracle9i as the database system. The HTTP server uses tomcat5 5. The client uses IE or Netscape and other browsers

Considering the data integration of the digital campus and the portability of the system, many school information systems are developed with Java language, and Oracle is used as the background database. The system is developed with JSP technology. In order to store resources reasonably, resources are classified. The school's organizational structure and curriculum resources were used [24]. As shown in Figure 7, the school is in the first floor, the department is in the second floor, and the curriculum is in the third floor. In this way, resources can be put into their own layer according to their ownership relationship. After adopting the hierarchical management of resources, it is convenient to implement fine-grained permission control on resources. That is, permission control can be performed for each resource, which can make the social and confidentiality requirements of resources. The system adopts the widely used authority management model (RBAC model). In order to facilitate the implementation of permission management, you can also set the access rights of the files storing resources. In addition, the resource layer can set permissions. Permissions can be subdivided into view list, read, modify, and delete. The folder and resource layer have upload permission.

4. Results and Analysis

4.1. Model of Deep Learning and Its Training. It is recommended to use vectors V and h to represent the state of the visual unit respectively. The states of the i-th view unit and the j-th view unit are represented as hidden units and may be represented as hidden units. And for V, H, and RBM, the coupling probability distribution of the system can be used strong fun, as shown in Equation (12):

$$E(v,h) = -\sum_{i=1}^{m}\sum_{j=1}^{m} W_{ij} v_i h_j - \sum_{i=1}^{n} v_i b_i - \sum_{j=1}^{m} h_j c_j, \tag{12}$$

where w_{ii} and c_i are performance management program variables. The connection between the visual and the hide unit, the displacement of the visual unit, and the displacement of the unit are displayed. The learning task of RBM is to find the aim to match the given learning data. The random selection of a given series of training data is conditional probability, because the hidden element conditional probability only depends phenomenal elements. The hidden unit is

$$p(h_j|v) = \sigma\left(\sum_{i=1}^{n} w_{ij} v_i + c_i\right). \tag{13}$$

In fact, display conditional probability unit can be easily obtained, as shown below:

$$p(v_j|h) = \sigma\left(\sum_{j=1}^{m} w_{ij}h_i + b_i\right), \tag{14}$$

Where the function is defined as $\sigma(\bullet)$. Then, the algorithm improves the method of obtaining model reconstruction values through very large Gibbs. The weight update criterion is

$$Vw_{ij} = \delta\left(<v_i h_j>_{data} - <v_i h_j>_{recon}\right), \tag{15}$$

where δ It is the hope value of data and the hope value of reconstructed data. It can be seen from the the input data and reconstruct the data. Using its differences, hidden RBM layers can be better extracted from explicit layer input. In addition, it can be seen from formula (15) that the calculation amount of this result is small, and the weight update is relatively simple. The multiplication is simple, the calculation is not large, and the weight update is relatively simple.

4.2. Software System Test

4.2.1. Function Test. Software testing is to find the errors in the running process of software system as soon as possible; usually, system testing is unit testing. That is, module testing. For unit testing, this paper uses the methods of black and white box testing to test the system. The testing methods of software system are various, but testing does not mean that all possible tests are carried out with a large amount of data. According to the characteristics and functions of the system, we should select some important operations that are closely related to the business in many test contents, so as to not only ensure the test in terms of quality, but also accurately find the problems and vulnerabilities of the system. In order to ensure the stable operation of the digital teaching resource management system in schools, it uses the two test methods of black box test and white box test and combines the core business of the system, namely, resource service and resource management; designs the system test cases; tests the system targeted; ensures that the test results are really reliable; and accurately grasps the performance of the system [25]. The system test cases are shown in Figures 8 and 9. As we all know, the difference mainly lies in the following two aspects: first, though consider the internal algorithm, and second, though consider the internal structure.

The black box test does not consider the algorithm and system internal architecture at all, but tests to determine whether the function conforms to the function description of the system. Therefore, the test is the name of the test feature. The functional test, also known as correctness test, checks whether the functions of the software meet the specifications and verifies the functions of the product. Check whether the product meets the functions required by users. Since correctness is the most important quality factor of software, its testing is also the most important.

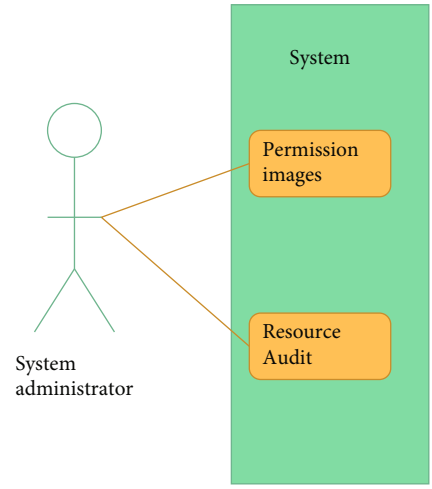

Figure 8: System administrator test case.

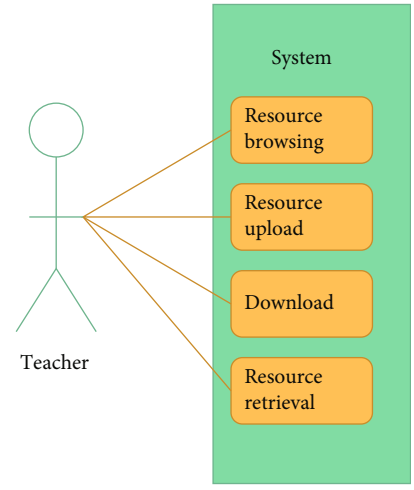

Figure 9: Test case diagram.

Table 1: File upload function module test.

Login status	File type	Result
Success	Prohibited class	Upload failed
Success	Allow class	Upload successful
Fail	Prohibited class	Upload failed
Fail	Allow class	Upload failed

(A) The test of file upload function module is shown in Table 1

(B) See Table 2 for details of form test

(C) User test in Table 3

Table 2: Form link test.

Operation	Expected results	Test result	Conclusion
Form link	Whether the specified form can be opened correctly	Can correctly open the form through the link	The results are consistent

4.2.2. Performance Test. Performance testing is an indispensable step in the overall process of software development. It realizes its testing through the performance evaluation of the test object. As for the performance test, the focus is on the analysis and evaluation of the characteristics of the corresponding time, execution flow, and execution accuracy in the process of executing some kinds of tests. The test results are obtained by testing different execution conditions in the system. Performance test is mainly through three index analysis, namely, load test, pressure test, and capacity test. Through the load test, the monitoring system can reach the expected value by giving the system load; Pressure test: test the operation of the system by constantly applying pressure to the system; The capacity test is mainly to the system meets the test requirements when problems are found in big data and management.

(1) College digital teaching resource is a software platform developed for college teaching resource management in China Net technology, a software platform for college teaching resource management application. It can be applied across platforms (UNIX, Linux, windows, etc.) without maintaining the client. At the same time, it also supports a variety of large databases, and the security mechanism is relatively perfect. In addition, the digital teaching resource management system in schools has its own characteristics in the technical architecture. It is a product of "platform/component" technical architecture. The products developed based on this platform are composed of "platform" and "component." Through the platform, the business system can be developed, deployed, and operated quickly and flexibly. Business requirements are realized through components. The performance of software is what customers care about. To improve the performance of college digital teaching resource management system and the characteristics of the test platform, the performance test and optimization of college digital teaching resource management system are carried out

(2) Performance test environment and preparation. The test scope is to test and run the business module of the university digital teaching resource management system and reflect university digital system through the main functions of the business system. The performance test tool used in this test is Compuware's QALoad, which can simulate multiple concurrent users sending requests to the server on one machine. At the same time, it can collect information such as system throughput and response time. The whole test process is tested in Microsoft's windows 2003 and SQL Server 2000 (SP3) environment, because saving credentials in the system is a typical operation, which performs corresponding operations on the application server and database server. Therefore, we will take the case of saving credentials as an example to explain the whole test process.

(3) Performance tuning process and test results. According to the performance requirements, this performance test does not include the optimization of the application, mainly the optimization of the middleware and database on the application server. Optimize the system until the CPU utilization exceeds 75%, and then optimize the system utilization. First, use the test tool QALoad to run the case and save the credentials. We start to run 10 concurrent users, and then add 10 concurrent users every 2 minutes to pressurize the system. When the system has 120, 140, and 170 concurrent users; the CPU utilization of the application server also exceeds 75%; but the

Table 3: Teacher login system test.

Teacher ID	Password	Result
Current login ID	Correct	Correct
Non-current login ID	Correct	Error
Non-current login ID	Error	Error
Garbled code	Error	Error

Table 4: QALoad test results.

Number of concurrent users	CPU utilization of app	CPU utilization of DB
130	79%	14%
150	78%	16%
180	79%	17%

Table 5: Test results.

Initial capacity of IDBC connection buffer pool	Response time (s)	CPU utilization of main program	CPU utilization of DB
35	8.924	31%	12%
35	7.037	7%	19%
35	7.629	7%	19%
40	7.582	7%	20%
40	7.921	7%	18%
40	7.206	7%	21%

CPU utilization of the database server is only about 18%. The specific parameters are shown in Table 4.

After the function and performance test, the performance of the university digital teaching resource management system has been greatly improved, the quality of the university teaching resource management system software has been improved, and the system has a stronger competitiveness in the market. From the test results, the performance of the software is very stable. It is completely affordable to deploy a running environment of 200-300 users on Microsoft's windows 2003 and SQL Server 2000 (SP3) platforms. The final result is shown in Table 5.

5. Conclusion

The teaching resource system realizes teaching resources and promotes the development of improving the efficiency of learning. The most convenient and effective way to share is to build a network resource management system. Through the construction of digital teaching resource in schools, through the demand analysis of the system, and the discussion on the architecture and functional modules, this paper designs in-depth details and realizes the construction of the system by using advanced design ideas and mature network development technology. The resource management system in schools has achieved the purposes of convenient maintenance, convenient data statistics, easy maintenance, simple and beautiful interface, efficient query and retrieval function, and so on. The development of college teaching resource is a systematic project, which integrates college teaching to the extent and realizes the sharing of teaching resource information. The whole development process mainly revolves around the system function module from demand analysis, system design, and system implementation. The resource management system in schools not only shares resources, but also provides a new teaching method, which can be used by more students, widens the access to learning resources, and improves learning efficiency. Finally, the digital teaching resource management system in schools runs stably and operates easily through the system test, which can teach and resource sharing in schools. The establishment of the system is more scientific for the management of teaching resources, reduces the labor intensity of human resources, improves the operation efficiency and has good practical significance.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there is no conflict of interest with any financial organizations regarding the material reported in this manuscript.

References

[1] B. Sudharsan, P. Patel, J. Breslin, M. I. Ali, and R. Ranjan, "Toward distributed, global, deep learning using IoT devices," *IEEE Internet Computing*, vol. 25, no. 3, pp. 6–12, 2021.

[2] Y. Han, Z. Wang, Q. Guo, and W. Xiang, "Deep learning-based detection for moderate-density code multiple access in IoT networks," *IEEE Communications Letters*, vol. 24, no. 1, pp. 122–125, 2020.

[3] A. Rusdiana, "Personalized system of instruction (psi) models: using digital teaching materials on learning," *Creativity and Innovation Management*, vol. 9, no. 5, pp. 314–324, 2020.

[4] S. Noreen, "Implementation of learning management system: a way ahead on the digital journey in distance learning," *Open Praxis*, vol. 12, no. 3, pp. 329–342, 2020.

[5] S. Al, "Implementation and design of wireless IoT network using deep learning," *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, vol. 12, no. 3, pp. 563–572, 2021.

[6] X. Liu, H. Li, G. Xu, S. Liu, and R. Lu, "Padl: privacy-aware and asynchronous deep learning for IoT applications," *IEEE Internet of Things Journal*, vol. 7, no. 8, pp. 6955–6969, 2020.

[7] E. Khedkar, "A deep learning method for effective channel allotment for SDN based IoT," *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, vol. 12, no. 2, pp. 1721–1728, 2021.

[8] Z. K. Maseer, R. Yusof, S. A. Mostafa, N. Bahaman, O. Musa, and B. A. Al-rimy, "Deepiot.ids: hybrid deep learning for enhancing iot network intrusion detection," *Computers, Materials and Continua*, vol. 69, no. 3, pp. 3945–3966, 2021.

[9] N. Zhang, L. Tan, F. Li, B. Han, and Y. Xu, "Development and application of digital assistive teaching system for anatomy," *Virtual Reality & Intelligent Hardware*, vol. 3, no. 4, pp. 315–335, 2021.

[10] Y. Wang, X. Liang, X. Hei, W. Ji, and L. Zhu, "Deep learning data privacy protection based on homomorphic encryption in AIoT," *Mobile Information Systems*, vol. 2021, no. 2, Article ID 5510857, pp. 1–11, 2021.

[11] I. Idrissi, M. Azizi, and O. Moussaoui, "Accelerating the update of a dl-based ids for IoT using deep transfer learning," *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 23, no. 2, pp. 1059–1067, 2021.

[12] D. R. Govindaraj, "An effectual plant leaf disease detection using deep learning network with IoT strategies," *Annals of the Romanian Society for Cell Biology*, vol. 25, no. 4, pp. 8876–8885, 2021.

[13] B. Mao, F. Tang, Y. Kawamoto, and N. Kato, "Optimizing computation offloading in satellite-UAV-served 6g IoT: a deep learning approach," *IEEE Network*, vol. 35, no. 4, pp. 102–108, 2021.

[14] M. Figueroa-Giralt, *Digital teaching*, vol. 72, no. 2, 2020Revista de Cirugía, 2020.

[15] V. H. Benitez-Baltazar, J. H. Pacheco-Ramírez, J. R. Moreno-Ruiz, and C. Núñez-Gurrola, "Autonomic face mask detection with deep learning: an IoT application," *Revista Mexicana de Ingenieria Biomedica*, vol. 42, no. 2, pp. 160–170, 2021.

[16] K. Shankar, E. Perumal, M. Elhoseny, and P. T. Nguyen, "An IoT-cloud based intelligent computer-aided diagnosis of diabetic retinopathy stage classification using deep learning approach," *Computers, Materials and Continua*, vol. 66, no. 2, pp. 1665–1680, 2021.

[17] T. H. Vu, T. V. Nguyen, and S. Kim, "Wireless powered cognitive Noma-based IoT relay networks: performance analysis and deep learning evaluation," *IEEE Internet of Things Journal*, vol. 9, no. 5, pp. 3913–3929, 2022.

[18] S. I. Popoola, R. Ande, B. Adebisi, G. Guan, and O. Jogunola, "Federated deep learning for zero-day botnet attack detection in IoT edge devices," *IEEE Internet of Things Journal*, vol. 9, no. 5, pp. 3930–3944, 2022.

[19] J. Zhang, X. Qi, S. H. Myint, and Z. Wen, "Deep-learning-empowered 3d reconstruction for dehazed images in IoT-enhanced smart cities," *Computers, Materials and Continua*, vol. 68, no. 2, pp. 2807–2824, 2021.

[20] K. V. Praveen, P. Prathap, S. Dhanasekaran, I. Punithavathi, and D. A. Pustokhin, "Deep learning based intelligent and sustainable smart healthcare application in cloud-centric IoT," *Computers, Materials and Continua*, vol. 66, no. 2, pp. 1987–2003, 2021.

[21] F. M. Amin and H. Sundari, "EFL students' preferences on digital platforms during emergency remote teaching: video conference, LMS, or messenger application?," *Studies in English Language and Education*, vol. 7, no. 2, pp. 362–378, 2020.

[22] A. Duraisamy, M. Subramaniam, and C. Robin, "An optimized deep learning based security enhancement and attack detection on IoT using ids and KH-AES for smart cities," *Studies in Informatics and Control*, vol. 30, no. 2, pp. 121–131, 2021.

[23] N. R. Mosteanu, "Using internet and EduTech become a primary need rather than a luxury - the reality: a new skilled educational system - digital university campus," *International Journal of Engineering Science Technologies*, vol. 4, no. 6, pp. 1–9, 2020.

[24] D. Pusca and D. O. Northwood, "Teaching and learning engineering design: creative methods for remote education," *World Transactions on Engineering and Technology Education*, vol. 19, no. 3, pp. 306–312, 2021.

[25] A. Rolgayzer, K. Demidenko, and A. Kadnikova, "Possibilities of applying information and communication technologies in teaching foreign languages at universities," *Scientific Research and Development Socio-Humanitarian Research and Technology*, vol. 9, no. 3, pp. 49–57, 2020.